TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED / ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		ATTORNEY'S DOCKET NUMBER P67554US0
		US APPLICATION NO (if known, see 37 CFR 1.5) 10/030092
INTERNATIONAL APPLICATION NO. PCT/JP00/03090	INTERNATIONAL FILING DATE 15 May 2000	PRIORITY DATE CLAIMED 15 May 2000
TITLE OF INVENTION FERTILIZERS CONTAINING AMMONIUM THIOSULFATE		
APPLICANT(S) FOR DO/EO/US Kikuo KISHIMOTO, Hiroshi NAGATA and Toru SUZUKI		

Applicant herein submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information.

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☐ A proper Demand for Internatl. Preliminary Examination was made by the 19th month from earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the Internatl. Preliminary Examination report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.
    ☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information:
    International Search Report - JPO
    First Page of Publication

US APPLICATION NO (If known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO	ATTORNEY'S DOCKET NUMBER
10/030092	PCT/JP00/03090	P67554US0

	CALCULATIONS	PTO USE ONLY
17. ☒ The following fees are submitted:		
Basic National Fee (37 CFR 1.492(a)(1)-(5)):		
Internatl. prelim. examination fee paid to USPTO (37 CFR 1.492 (a) (1)) . . $710.00		
No international preliminary examination fee paid to USPTO (37 CFR 1.492 (a) (2)) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) . . $740.00		
Neither international preliminary examination fee (37 CFR 1.492 (a) (3)) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO) **$1040.00**		
International preliminary examination fee paid to USPTO (37 CFR 1.492 (a) (4)) and all claims satisfied provisions of PCT Article 33(2)-(4) $100.00		
Search Report prepared by the EPO or JPO (37 CFR 1.492 (a) (5)) **$890.00**		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 890.00	
Surcharge of $130.00 for furnishing the **oath or declaration** later than ☒ **20** ☐ **30** months from the earliest claimed priority date (37 CFR 1.492(e)).	$ 130.00	

Claims	**Number Filed**	**Number Extra**	Rate		
Total Claims	**5** - 20 =	-0-	x $18.00	$	
Independent Claims	**4** - 3 =	-1-	x $84.00	$ 84.00	
Multiple Dependent Claim(s) (if applicable)			+ $280.00	$	
TOTAL OF ABOVE CALCULATIONS =				$ 1104.00	
Reduction by 1/2 for filing by **small entity**, if applicable. Verified Small Entity statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28).				$	
SUBTOTAL =				$ 1104.00	
Processing fee of $130 for furnishing the **English translation** later than ☐ **20** ☐ **30** months from the earliest claimed priority date (37 CFR 1.492(f))				$	
TOTAL NATIONAL FEE =				$ 1104.00	
Fee of $40.00 for recording the enclosed **assignment** (37 CFR 1.21(h)). Assignment must be accompanied by appropriate cover sheet (37 CFR 3.28, 3.31).				$	
TOTAL FEES ENCLOSED =				$ 1104.00	
				Amt. to be refunded:	$
				Amt. charged:	$

a. ☒ A check in the amount of $ 1104.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. 06-1358 in the amount of $ ____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge my account any additional fees set forth in §1.492 during the pendency of this application, or credit any overpayment to Deposit Account No. 06-1358. A duplicate copy of this sheet is enclosed.

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JPH&S 3/95

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Kikuo KISHIMOTO et al.

Serial No.: New

Filing Date: January 15, 2002

For: FERTILIZERS CONTAINING AMMONIUM THIOSULFATE

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to initial examination, please amend the above-identified application as follows:

IN THE SPECIFICATION

On page 1, immediately following the title, please insert the following sentence: --This is a nationalization of PCT/JP00/03090 filed May 15, 2000 and published in Japanese.--

IN THE CLAIMS

Please amend claim 5 as follows:

5. (amended) The granular or powdery ammonium thiosulfate-containing fertilizer of claim 1, wherein said ATS-carrying material is zeolite, bentonite, acid clay, or a porous material selected from among diatomaceous earth, autoclaved lightweight concrete (hereinafter called ALC) powder and white carbon.

REMARKS

The foregoing Preliminary Amendment is requested in order to delete the multiple dependent claims and avoid paying the multiple dependent claims fee.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "**VERSION WITH MARKINGS TO SHOW CHANGES MADE.**"

Early action on the merits is respectfully requested.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS

5. (amended) The granular or powdery ammonium thiosulfate-containing fertilizer of claim 1 [any one of claims 1 through 4], wherein said ATS-carrying material is zeolite, bentonite, acid clay, or a porous material selected from among diatomaceous earth, autoclaved lightweight concrete (hereinafter called ALC) powder and white carbon.

SPECIFICATION

AMMONIUM THIOSULFATE-CONTAINING FERTILIZER

Technical Field of the Invention

The present invention relates to a fertilizer prepared by powdering or granulating an aqueous solution of ammonium thiosulfate (hereinafter referred to as ATS) having nitrogen (N) and sulfur (S) as its components.

Background of Arts

ATS is commercially distributed in the form of aqueous solutions and its use as a fertilizer is limited to liquid fertilizers. As such, ATS cannot be used in combination with other fertilizers except liquid fertilizers of pH 6 or more, such as those of nitrogen, phosphoric acid and potassium. In addition, since ATS causes chemical damage to plants, it is applied at distances of 5 cm laterally from and 5 cm below each seed.

Problems to be Solved by the Invention

However, in the conventional use of ATS (liquid fertilizer), fertilizers that can be used in combination therewith are limited to liquid fertilizers. In addition, the site of application is also subject to limitation, as described above; erroneous positioning can cause chemical damage.

Having been developed in view of this drawback in the prior art, the present invention is intended to provide a fertilizer of the environmental protection type that is easy to handle, that avoids plant damage from ATS, and that minimizes the leaching of nitrogen components into rivers, lakes and ponds due to their nitrification in soil.

Disclosure of Invention

Aiming at accomplishing this objective, the present inventors conducted

investigations on various issues as described below.

1) In an attempt to avoid the development of chemical damage due to application of ATS and to broaden its applicability as a fertilizer, the present inventors investigated the mechanism of development of the chemical damage.

As a result of various surveys, the primary factor of development of the chemical damage was identified as ATS-derived sulfur (S) released upon the reaction shown by Formula 1:

$(NH_4)_2S_2O_3 + O = (NH_4)_2SO_4 + S$ (Formula 1)

The inventors made further investigations and found that the chemical damage can be avoided by finely pulverizing (powdering) or granulating the aqueous ATS solution to prevent the resulting sulfur (S) from coming into direct contact with the roots or leaves of the plant.

Accordingly, it is an object of the present invention to provide an ammonium thiosulfate-containing fertilizer as is or as granulated and dried, that is prepared by adding an aqueous solution of ammonium thiosulfate (hereinafter referred to as ATS) at 1-50% by weight to a material of high base exchange capacity (zeolite, bentonite, acid clay, etc.) or a porous material (diatomaceous earth, autoclaved lightweight concrete (hereinafter called ALC) powder, white carbon, etc.) (these materials are hereinafter generically referred to as ATS-carrying materials), and adding in advance an acid or an acidic material to adjust the resulting mixture to a pH of about 7.

It is a second object of the present invention to provide a powdery or granular ammonium thiosulfate-containing fertilizer prepared by adding an aqueous ATS solution at 1-15% by weight to a fertilizer powder containing one or more components selected from

among nitrogen, phosphoric acid and potassium with or without addition of an ATS-carrying material.

It is a fourth object of the present invention to provide a granular ammonium thiosulfate-containing fertilizer prepared by spraying an aqueous ATS solution at 1-15% by weight to the surface of fertilizer grains containing one or more components selected from among nitrogen, phosphoric acid and potassium, and subsequently drying the solution or coating the solution with an ATS-carrying material at 1-10% by weight.

Fertilizers produced by the method described above were found to possess good physical properties and to be usable without solidification even after long-term storage. In addition, these fertilizers can be dried without particular chemical reactions even if thermally dried at product temperatures between 70 and 80°C.

Best Modes Carry out the Invention

The present invention is hereinafter described in more detail by means of the following examples.

Having been developed on the basis of the findings described above, the present invention provides a powdery or granular ATS-containing fertilizer comprising as follows:

1) An aqueous solution containing 70-80% by weight/volume ATS in an amount equivalent to 1.0-50% by weight is added to an ATS-carrying material such as diatomaceous earth, bentonite, acid clay, ALC powder or white carbon. This ATS-carrying material has an acid or an acidic material, such as calcium superphosphate (lime of superphosphate) or monoammonium phosphate (MAP), which is previously added at about 1% by weight to adjust the resulting mixture to a pH between 5.5 and 7.6.

2) An acidic material for pH regulation and ammoniac odor elimination is added to zeolite,

diatomaceous earth, bentonite, ALC powder, acid clay or white carbon as an ATS-carrying material. This mixture is granulated while an aqueous ATS solution is added. A granulation aid (binder) is added as necessary.

It is desirable that the granulation aid (binder) used be gypsum, bentonite, blackstrap molasses, lignin waste liquid, or the like. The granulated product is used as is or dried to yield a finished product.

3) An aqueous ATS solution is added at 1-15% by weight to a fertilizer powder containing one or more components selected from among nitrogen, phosphoric acid and potassium with or without addition of an ATS-carrying material such as diatomaceous earth, and this mixture is used as is or dried to yield a finished product.

4) A fertilizer powder containing one or more components selected from among nitrogen, phosphoric acid and potassium with or without addition of an ATS-carrying material such as diatomaceous earth is granulated while an aqueous ATS solution is added at 5-20% by weight, and the granulated product is used as is or dried to yield an ATS-containing fertilizer.

5) An aqueous ATS solution is sprayed at 4-8% by weight to a granular fertilizer containing one or more components selected from among nitrogen, phosphoric acid and potassium, and coated as necessary with a powder of an ATS-carrying material such as diatomaceous earth, and this mixture is used as is or dried to yield an ATS-containing fertilizer.

The ATS concentrations of the aqueous solutions of ATS used in processes 2) through 5) above are 70-80% by weight/volume as with process 1).

To describe a production method for an ATS-containing fertilizer to which the present invention is advantageously applicable and its fertilizer effects, test examples and

working examples are given below. These examples are given for the sake of exemplification and are not to be construed as limitative on the scope of the invention.

Test Example 1

Effects of amount of ATS added to ATS-carrying material on the physicochemical properties of the resulting mixture

Various amounts of an acidic material and an aqueous ATS solution were added to an ATS-carrying material, and the physicochemical properties of each mixture were examined. The results obtained (Table 1) show that in the absence of an acidic material for pH regulation in the ATS-carrying material (No. 1), the mixture had a pH of about 8 and produced a strong ammoniac odor. When the acidic material was added at 0.1-0.3% by weight, however, the mixture had a pH between 5.5 and 7.6 and was free from an ammoniac odor. Although the ease of granulation was poor except when bentonite was used as an ATS-carrying material, it was improved by adding gypsum or blackstrap molasses at 1-5% by weight as a granulation aid (binder). The test results described above demonstrate that an acid or an acidic material is essential, and that it is desirable to add a binder such as gypsum or blackstrap molasses during granulation.

Table 1

No.	ATS-carrying material	Amount of ATS added	pH regulator	Granulation aid	pH	Ammoniac odor	Ease of granulation
1	Diatomaceous earth	20%*[1]	–	–	7.9	Yes	Poor
2	Diatomaceous earth	20%	MAP*[2]0.1%	–	6.8	Yes	Poor
3	Diatomaceous earth	20%	MAP0.2%	–	6.8	No	Poor
4	Diatomaceous earth	20%	Calcium superphosphate*[3], 0.1%	–	6.7	No	Poor
5	Diatomaceous earth	20%	Calcium superphosphate, 0.5%	–	5.5	No	Poor

6	Diatomaceous earth	40%	Calcium superphosphate, 0.2%	_	6.7	No	Poor
7	Diatomaceous earth	40%	Calcium superphosphate, 0.4%	_	6.7	No	Poor
8	Diatomaceous earth	50%	Calcium superphosphate, 0.5%	_	6.7	No	Poor
9	Bentonite	40%	Calcium superphosphate, 0.3%	_	7.0	No	Good
10	Bentonite	40%	Calcium superphosphate, 0.3%	Gypsum* , 1%	7.0	No	Good
11	Bentonite	40%	Calcium superphosphate, 0.3%	Gypsum, 5%	6.6	No	Good
12	Zeolite	40%	Calcium superphosphate, 0.3%	_	6.8	No	Poor
13	Acid clay	40%	Calcium superphosphate, 0.3%	_	6.7	No	Poor
14	Acid clay	40%	Calcium superphosphate, 0.3%	Gypsum, 2%	6.7	No	Good
15	ALC powder*	40%	Calcium superphosphate, 0.3%	_	7.2	No	Poor

Note:*1 ATS: 75% aqueous solution, pH 8.6

*2 MAP: Monoammonium phosphate for fertilizers, pH 4.1

*3 Calcium superphosphate: Superphosphate of lime, pH 2.8

*4 Gypsum: Gypsum as byproduct from stack gas desulfurization facility, pH 7.0

*5 ALC powder: Milled autoclaved lightweight concrete, pH 9.6

Example 1

40 kg of an aqueous solution containing 75% by weight/volume of ATS was added

to 50.9 kg of diatomaceous earth supplemented with 0.1 kg of monoammonium phosphate, an acidic material, to yield 100 kg of an ATS-containing fertilizer having a nitrogen (N) content of 4.4% and a sulfur (S) content of 10.4%.

This fertilizer was found to be an easy-to-handle odorless dry powder and did not solidify even after being kept standing for a long time. The product's pH was 6.7. 5 g of this product was added to 5 kg of soil in a a/5000 pot and 5 g of a 15-15-15 chemical fertilizer was added. *Komatsuna* seeds were sown to this pot in an upland field condition, and seedlings were grown and examined for chemical damage and growth in comparison with an ATS-free fertilizer.

The results obtained showed that no chemical damage was observed with either fertilizer and good growth was achieved. The leaching loss of nitrogen (N) applied was not measured for the ATS-containing fertilizer since it was evident from the results in Table 3 that the loss was minimal.

Test Example 2

Effects of amount of aqueous ATS solution added to commercially available fertilizer on the physicochemical properties of heated mixture

To a commercially available ordinary fertilizer, an aqueous ATS solution was added in various amounts. The physicochemical properties of the resulting mixture and the chemical changes during its heating at a product temperature of about 80°C were examined using trial sample Nos. 16 through 35, as shown in Table 2.

The results obtained (Table 2) showed that the maximum possible amount of aqueous ATS solution added to a fertilizer powder was up to 15%, and that it was desirable from the viewpoint of condition of the mixture to add the aqueous ATS solution at 7-15%. It was also shown that a good ATS-containing fertilizer was obtained by spraying an aqueous ATS solution at 3-15% by weight to a commercially available ordinary granular

fertilizer, and coating it with diatomaceous earth or the like. In addition, the powder mixture was shown to permit granulation without the addition of a granulation aid. In addition, these products showed no chemical changes even when thermally dried at product temperatures between 70 and 80°C.

Table 2

No.	Commercially available fertilizer	Amount of ATS added	Condition-im proving agent	Mixture appearance	pH	Ease of granulation	Changes during heating
16	MAP powder	7%	-	Dry	6.3	Poor	None
17	MAP powder	10%	-	Slightly wet	6.6	Fair	None
18	MAP powder	10%	Bentonite 3%	Dry	6.6	Good	None
19	MAP powder	13%	Bentonite 3%	Slightly wet	6.7	Good	None
20	MAP powder	15%	Diatomaceous earth 2%	Slightly wet	6.7	Good	None
21	MAP powder	15%	Diatomaceous earth 3%	Slightly wet	6.7	Good	None
22	MAP powder	20%	Diatomaceous earth 3%	Slightly wet	6.8	Good	Slight sulfuric odor
23	MAP grains	7%	Diatomaceous earth 4%	Dry	6.3	Poor	None
24	DAP powder	5%	-	Dry	7.4	Fair	None
25	DAP powder	7%	-	Dry	7.6	Fair	None
26	DAP powder	10%	-	Slightly wet	7.6	Good	None
27	DAP powder	10%	Diatomaceous earth 2%	Slightly wet	7.6	Good	None
28	DAP powder	13%	Diatomaceous earth 3%	Slightly wet	7.7	Good	None
29	DAP powder	15%	Diatomaceous earth 3%	Slightly wet	7.7	Good	Slight sulfuric odor
30	DAP powder	20%	Diatomaceous earth 4%	Slightly wet	7.8	Good	Slight sulfuric odor
31	DAP gains	4%	Diatomaceous earth 4%	Dry	7.4	-	None
32	DAP gains	5%	Diatomaceous earth 4%	Dry	7.6	-	None

33	DAP gains	15%	Diatomaceous earth 4%	Slightly wet	7.6	-	None
34	15-15-15 chemical fertilizer	7%	Diatomaceous earth 3%	Slightly wet	7.0	Fair	None
35	15-15-15 chemical fertilizer	10%	Diatomaceous earth 3%	Slightly wet	7.0	Good	Slight sulfuric odor

ATS: A 75% by weight/volume aqueous solution was used.

Although diatomaceous earth and bentonite were used as condition-improving agents in this test example, similar effects were obtained with zeolite, ALC, acid clay, and white carbon.

The ease of granulation was evaluated on the basis of the results obtained using a pan-type tester. Regarding changes during heating, the results obtained after heating at a product temperature of 80°C for 40 minutes are shown. It should be noted that the sulfuric odor perceived during heating disappeared after cooling.

DAP refers to diammonium phosphate for fertilizers, having a pH of 7.6.

MAP refers to monoammonium phosphate for fertilizers, having a pH of 4.1.

Test Example 3

To evaluate the nitrification-suppressing effect of ATS, experiments were conducted in test plots 1 through 4 (Table 3). To the Ando soil with surface humus (Suginami-ku, Tokyo) shown in Table 4, nitrogen was added at the ratios shown in Table 3. At 7, 14 and 21 days after the addition of nitrogen, changes in soil condition were examined by the test method described below.

Test method

A test sample in an amount equivalent to 25 mg of nitrogen (N) was placed in a 200 ml conical flask containing 50 g of the soil, and desalinated water was added to adjust the soil water content to 60% of the maximum water holding capacity. The flask was placed in a constant-temperature chamber at 30±1°C and removed from the chamber and

assayed for ammonium nitrogen and nitrate nitrogen contents on specified days. The results are shown in Tables 5 and 6.

Results

When the aqueous ATS solution was added in amounts equivalent to N concentrations of 10% or more relative to the N content of ammonium sulfate, a considerably decreased nitrification rate of 13.6% was obtained as compared with the value of 30.4% obtained without the addition of ATS.

This finding demonstrates that it is desirable to add ATS at 10% or more.

Table 3

Test Plots

Test Plots	Mixing ratio (%) of nitrogen added	
	Aqueous solution of ATS	Ammonium sulfate
1)	0%	100%
2)	5%	95%
3)	10%	90%
4)	15%	85%

Note: The amount of N added per plot was 25 mg.

Table 4

Test Sample Soil

Ando soil with Surface Humus (Suginami-ku, Tokyo)

pH		CEC	Maximum water
H_2O	KCL	(meq/dry soil)	holding capacity (%)
5.6	4.9	36.1	105

Table 5

Test Results (1)

Assay Values for Ammonium Nitrogen and Nitrate Nitrogen (per 50 g of Soil)

Component	NH_4-N			NO_3-N		
Days elapsed / Test plot	7 days	14 days	21 days	7 days	14 days	21 days
1)	23.1	21.1	17.5	3.7	5.9.	9.8
2)	23.5	21.5	20.3	3.4	5.3	7.1
3)	23.8	22.7	21.8	3.1	4.5	5.6
4)	24.0	23.1	22.4	2.7	4.0	5.0
No addition	0.4	0.4	0.6	2.3	2.2	2.2

Table 6

Nitrification Rate

Component	Nitrification rate		
Days elapsed / Test plot	7 days	14 days	21 days
1)	5.6	14.8	30.4
2)	4.4	14.8	19.6
3)	3.2	9.2	13.6
4)	1.6	7.2	11.2

Note: The nitrification rate indicates the ratio to total nitrogen content in the sample.

Example 2

88 kg of a powder of diammonium phosphate (DAP) was placed in a pan-type granulating machine and granulated while 12 kg of a 75% by weight/volume aqueous ATS solution, to yield 100 kg of a fertilizer. The granulated product obtained was found to be dry grains of pH 7.6 containing 19.1% of N, 40.5% of P_2O_5 and 3% of S.

This granulated product was dried at a product temperature of 80°C for 40 minutes to yield 97 kg of a finished product. 5 g of this fertilizer was added to 5 kg of soil in a a/5000 pot. *Komatsuna* seeds were sown to this pot in an upland field condition, and

seedlings were grown and examined for chemical damage and growth. The results obtained showed that there was no chemical damage due to ATS, and that the seedlings exhibited good growth.

Example 3

92 kg of granular DAP was placed in a pan-type granulating machine, and 5 kg of a 75% by weight/volume aqueous ATS solution was sprayed. Subsequently, the granules were coated while 3 kg of diatomaceous earth, a porous ATS-carrying material, was added. The coated product was thermally dried at a product temperature of 80°C for 40 minutes. The thermally dried product was found to have a pH of 7.5 and to contain 17.4% of N, 43.9% of P_2O_5 and 1.3% of S. *Komatsuna* was cultivated in the same manner as Example 2 and the seedlings exhibited good growth.

Example 4

To 41 kg of the ATS-containing DAP-based granular dry fertilizer obtained in Example 2, 16 kg of granular ammonium sulfate, 12 kg of granular urea and 28 kg of granular potassium chloride were added. Furthermore, 3 kg of diatomaceous earth was added as an anti-solidification to yield 100 kg of a BB fertilizer.

This fertilizer is a high-content composite fertilizer containing 16.7% of N, 16.6% of P_2O_5, 16.8% of K_2O and 2.1% of S. *Komatsuna* was cultivated in the same manner as Example 2 to evaluate the fertilizer efficiency of this fertilizer in comparison with an ATS-free control plot. The results obtained showed that the seedlings exhibited good growth in both plots.

Industrial Applicability

By powdering or granulating ATS, whose handlability and applicability are limited due to its form of distribution as a liquid, by the present invention using an ATS-carrying material, various effects are obtained as follows:

1) Transport, storage and handling of ATS are facilitated.

2) Chemical damage from ATS is avoided.

3) Mixing with ordinary fertilizers other than liquid fertilizers is permitted. When mixed with a nitrogen fertilizer, in particular, the ATS-containing fertilizer of the present invention reduces the leaching loss of N and contributes to the suppression of eutrophication of lakes, ponds and rivers because the nitrification of nitrogen is suppressed.

4) Because the biological availability of fertilizer applied, especially that of N improves, the amount of fertilizer applied is reduced.

What is claimed is:

1. A powdery ammonium thiosulfate-containing fertilizer prepared by adding an aqueous solution of ammonium thiosulfate (hereinafter referred to as ATS) to a material of high base exchange capacity and/or a porous material (hereinafter referred to as an ATS-carrying material) at 1-50% by weight, and adding an acid or an acidic material to adjust the resulting mixture to a pH between 5.5 and 7.6.

2. A powdery or granular ammonium thiosulfate-containing fertilizer prepared by adding an aqueous ATS solution at 1-15% by weight to a fertilizer powder containing one or more components selected from among nitrogen, phosphoric acid and potassium with or without the addition of an ATS-carrying material.

3. A granular ammonium thiosulfate-containing fertilizer prepared by granulating an ATS-carrying material while an aqueous ATS solution is added, wherein the concentration of said aqueous ATS solution is 5-20% by weight.

4. A granular ammonium thiosulfate-containing fertilizer prepared by spraying an aqueous ATS solution at 1-15% by weight to the surface of fertilizer particles containing one or more components selected from among nitrogen, phosphoric acid and potassium, and subsequently drying the particles or coating them with an ATS-carrying material at 1-10%.

5. The granular or powdery ammonium thiosulfate-containing fertilizer of any one of claims 1 through 4, wherein said ATS-carrying material is zeolite, bentonite, acid clay, or a porous material selected from among diatomaceous earth, autoclaved lightweight concrete (hereinafter called ALC) powder and white carbon.

Abstract

Ammonium thiosulfate (ATS)-containing fertilizers of the environmental protection type. Powdery fertilizers containing a powdery ATS-containing ***fertilizer***, which is prepared by adding 1 to 50% by weight of an aqueous ATS solution to a material having a base exchange capacity and/or a porous material (hereinafter referred to as ATS-carrying material(s)) followed by mixing and adding an acid or an acidic material to the resultant mixture to thereby adjust the mixture to pH 5.5 to 7.6, and one or more components selected from among nitrogen, phosphoric acid and potassium; or powdery or granular ATS-containing fertilizers obtained by adding the ATS-carrying material(s) to the powdery ***fertilizer*** and further adding 1 to 15% by weight of an aqueous ATS solution followed by mixing.

10030092.072202

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NON PRIORITY; OR PROVISIONAL APPLICATIONS

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ATTORNEYS' DOCKET NO.

101 102

As a below named inventor, I declare that my residence, post office address and citizenship are stated below next to my name, the information given herein is true, that I believe that I am the original, first and sole inventor (if only one name is listed at 201 below), or an original, first and joint inventor (if plural inventors are named below at 201-203, or on additional sheets attached hereto) of the subject matter which is claimed and for which patent is sought on the invention entitled:

Fertilizers containing ammonium thiosulfate

which is described and claimed in:

☒ PCT International Application No. PCT/JP00/03090 filed May 15, 2000

☐ the attached specification

☐ the specification in application Serial No. _____ filed _____

(if applicable) and amended on _____

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.
I acknowledge the duty to disclose information which is material to patentability as defined in Title 37 Code of Federal Regulations, §1.56.
I hereby claim foreign priority benefits under Title 35, United States Code, §119 (a)-(d) of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

103 104

Prior Foreign Application(s) (Number)	(Country)	(Day/Month/Year Filed)	Priority Claimed Yes	No
			☐	☐
			☐	☐
			☐	☐

I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional application(s) listed below:

Application No. _____ Filing Date _____ Application No. _____ Filing Date _____

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I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37 Code of Federal Regulations, §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Serial No.)	(Filing Date)	(Status: patented, pending, abandoned)

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorneys (Registration No.) to prosecute this application, receive and act on instructions from my agent, and transact all business in the Patent and Trademark Office connected therewith HARVEY B. JACOBSON, JR. (20,851); D. DOUGLAS PRICE (24,514); JOHN CLARKE HOLMAN (22,769); MARVIN R. STERN (20,640); ALLEN S. MELSER (27,215); MICHAEL R. SLOBASKY (26,421); JONATHAN L. SCHERER (29,851); IRWIN M AISENBERG (19,007); WILLIAM E. PLAYER (31,409); YOON S. HAM (45,307) and NATHANIEL A. HUMPHRIES (22,772)

SEND CORRESPONDENCE TO: CUSTOMER NO. 00136 or JACOBSON, PRICE, HOLMAN & STERN PROFESSIONAL LIMITED LIABILITY COMPANY 400 SEVENTH STREET, N.W. WASHINGTON, D.C. 20004	DIRECT TELEPHONE CALLS TO: (please use Attorney's Docket No) (202) 638-6666 JACOBSON, PRICE, HOLMAN & STERN PROFESSIONAL LIMITED LIABILITY COMPANY

*Inventor(s) name must include at least one unabbreviated first or middle name.

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I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both, under section 1001 of Title 18 of the United States Code; and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 201*	SIGNATURE OF INVENTOR 202*	SIGNATURE OF INVENTOR 203*
岸本菊夫	[signature]	[signature]
DATE 2002/7/10	DATE 10, July, 2002	DATE 05, July, 2002

☐ Additional inventors are named on separately numbered sheets attached hereto.